MHT CET 2020 PCM Oct 13 Shift 2 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 180 Minutes **Total Questions: 150** **Maximum Marks: 200**

General Instructions

(i) This **PCM** paper is from **MHT CET 2020**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

(ii) Answer all **150 multiple choice questions**: **50 Physics**, **50 Chemistry** and **50 Mathematics**.

(iii) Each question offers **four choices**, with **one correct answer**.

(iv) Allow **90 minutes for Physics and Chemistry together**, followed by **90 minutes for Mathematics**. The first group closes before the second opens.

(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

(vi) There is **no negative marking**. Unanswered questions score zero.

1. The sum of the magnitudes of two vectors $\vec{A}$ and $\vec{B}$ is 8 and magnitude of the resultant is 4. If the resultant vector is perpendicular to any one vector, then the magnitudes of the two vectors $\vec{A}$ and $\vec{B}$ are

(A) 3,5 (B) 2,6

(C) 4,4 (D) 1, 7

2. The errors in the measurement of mass and length of the cube is 1.5% and $2 \cdot 5\%$ respectively. The percentage error in the measurement of density of a cube is

(A) 3% (B) 1.5%

(C) 6% (D) 9%

3. Let the two forces have equal magnitude ' A'. If the magnitude of the resultant is $\frac{2\,A}{3}$ then the angle between those two forces is

(A) $\cos^{-1}\left(+\frac{7}{9}\right)$ (B) $\cos^{-1}\left(-\frac{7}{9}\right)$

(C) $\cos^{-1}\left(-\frac{5}{9}\right)$ (D) $\cos^{-1}\left(+\frac{5}{9}\right)$

4. A Diwali cracker releases 25 gram gas per second, with a speed of 400 ms^{-1} after explosion. The force exerted by gas on the cracker is

(A) 100 dyne (B) 16 newton

(C) 10 newton (D) 10,000 dyne

5. A block of mass 'm', kept on a horizontal surface, is moved through a distance 's' by applying a horizontal force (F) to it. What is the work done by the normal reaction?

(A) $\frac{F}{s}$ (B) Fs

(C) zero (D) $\frac{S}{F}$

6. A bucket containing water is revolved in a vertical circle of radius ' r'. To prevent the water from falling down, the minimum frequency of revolution required is [g = acceleration due to gravity]

(A) $\frac{1}{2\pi}\sqrt{\frac{g}{r}}$ (B) $2\pi\sqrt{\frac{g}{r}}$

(C) $\frac{2\pi g}{r}$ (D) $\frac{1}{2\pi}\sqrt{\frac{r}{g}}$

7. A rotating body has angular momentum 'L'. If its frequency of rotation is halved and rotational kinetic energy is doubled, its angular momentum becomes

(A) 2 L (B) $\frac{L}{4}$

(C) 4 L (D) $\frac{L}{2}$

8. A disc of mass 10 kg and radius $0 \cdot 1$ m is rotating at 120 r.p.m. A retarding torque brings it to rest in 10 s. If the same torque is due to force applied tangentially on the rim of the disc then magnitude of force is

(A) 0.2πN (B) $0 \cdot 4\pi$N

(C) 0.8πN (D) $0 \cdot 1\pi$N

9. Earth revolves round the sun in a circular orbit of radius 'R'. The angular momentum of the revolving earth is directly proportional to

(A) R^2 (B) R^3

(C) $\sqrt{R}$ (D) R

10. A solid sphere of mass 'M' and radius 'R' is rotating about its diameter. A disc of same mass and radius is also rotating about an axis passing through its centre and perpendicular to the plane but angular speed is twice that of the sphere. The ratio of kinetic energy of disc to that of sphere is

(A) 5 : 1 (B) 6 : 1

(C) 4 : 1 (D) 3 : 1

11. The period of revolution of a satellite is

(A) independent of mass of a satellite. (B) independent of radius of planet.

(C) dependent on the mass of a satellite. (D) independent of height of the satellite from the planet.

12. A force of 10 N is required to break a wire of radius 1 mm. The force required to break the wire of same material, but radius 3 mm will be

(A) $\frac{10}{9}$ N (B) $\frac{10}{3}$ N

(C) 90 N (D) 30 N

13. Two small drops of liquid of same radius coalesce to form a big drop. The ratio of the total surface energies after and before the change is

(A) $2^{\frac{1}{3}} : 1$ (B) $2^{-\frac{1}{3}} : 1$

(C) $2^{-\frac{2}{3}} : 1$ (D) $2^{\frac{2}{3}} : 1$

14. Water is flowing through a horizontal pipe of non-uniform cross-section. In the region of narrowest part inside the pipe, the water will have

(A) maximum velocity and minimum pressure.
(B) both the pressure and velocity maximum.
(C) both the pressure and velocity minimum.
(D) maximum pressure and minimum velocity.

15. The excess pressure inside a spherical drop of water is three times that of another drop of water. The ratio of their surface area is

(A) 3 : 1
(B) 6 : 1
(C) 1 : 9
(D) 1 : 3

16. A metal rod of Young's modulus 'Y' and coefficient of linear expansion ' α' has its temperature raised by ' $\Delta\theta'$. The linear stress to prevent the expansion of rod is (L and ℓ is original length of rod and expansion respectively)

(A) $Y\frac{L}{\ell}$
(B) $\frac{Y\alpha}{\Delta\theta}$
(C) $Y \propto \Delta\theta$
(D) $Y\left(\frac{\ell}{L}\right)^2$

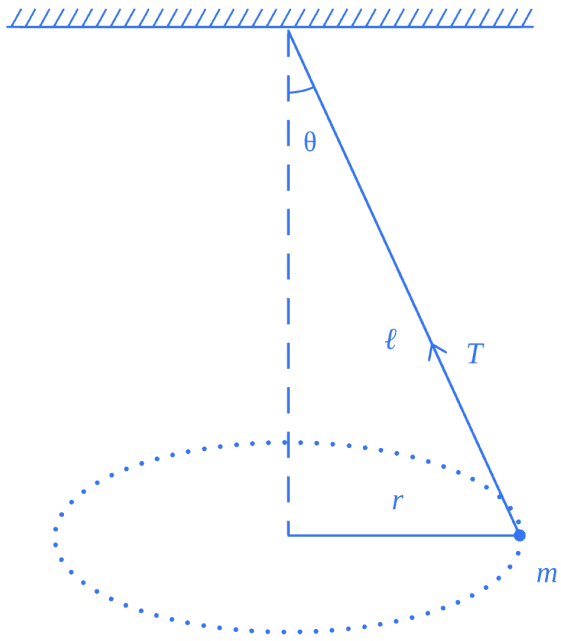
17. Two spheres 'S_1' and 'S_2' have radii 'R' and '3R', temperature 'T'K and $\frac{T}{3}$ K respectively. If they are coated with a material of same emissivity, rate of radiation of 'S_1' is E then rate of radiation of S_2' is (spheres are of the same material)

(A) $\frac{E}{6}$.
(B) $\frac{E}{3}$.
(C) $\frac{E}{9}$.
(D) $\frac{E}{12}$.

18. One mole of a diatomic gas does a work $\frac{Q}{3}$, when the amount of heat supplied is 'Q'. In this process, the molar heat capacity of the gas is

(A) $\frac{15R}{4}$
(B) $\frac{9R}{4}$
(C) $\frac{7R}{4}$
(D) $\frac{3R}{4}$

19. A string of length ' ℓ ' fixed at one end carries a mass 'm' at the other end. The string makes $\frac{3}{\pi}$ revolutions / second around the vertical axis through the fixed end as shown in figure. The tension 'T' in the string is



(A) 36 mℓ
(B) 3 mℓ
(C) 9 mℓ
(D) 18 mℓ

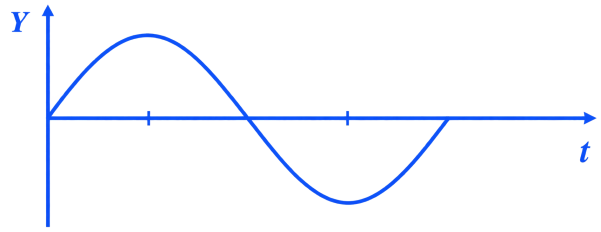
20. A body performs linear simple harmonic motion of amplitude 'A". At what displacement from the mean position, the potential energy of the body is one fourth of its total energy?

(A) $\frac{A}{3}$
(B) $\frac{A}{2}$
(C) $\frac{3A}{4}$
(D) $\frac{A}{4}$

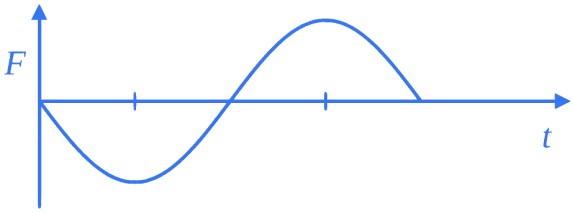
21. A pendulum is oscillating with frequency 'n' on the surface of earth. If it is taken to depth $\frac{R}{2}$ below the surface of earth where R is radius of earth. New frequency of oscillations at depth $\frac{R}{2}$ is

(A) $\frac{n}{\sqrt{2}}$
(B) **n**
(C) $\frac{n}{\sqrt{3}}$
(D) $2n$

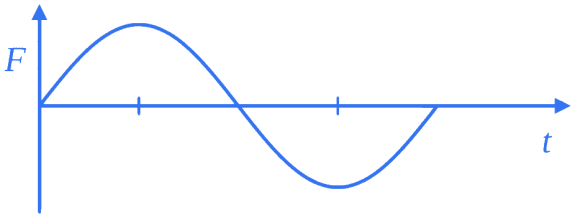
22. For a particle performing S.H.M., the displacement-time graph is as shown.



For that particle the force-time graph is correctly shown in graph

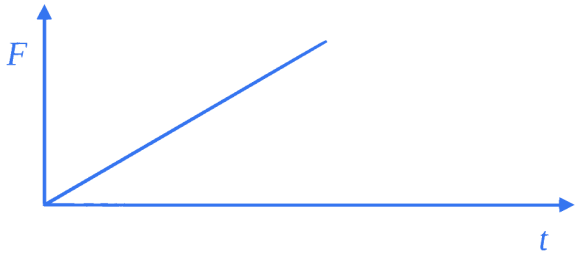


(A)

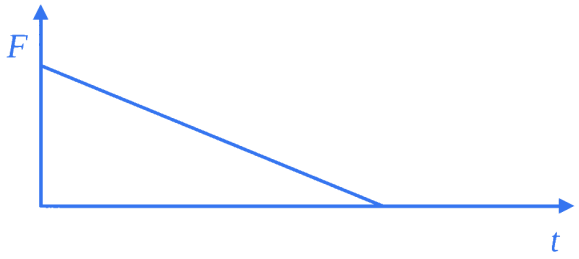


(B)

22. (continued)



(C)



(D)

(A) (A) (B) (B)
(C) (C) (D) (D)

23. A train blowing the whistle moves with a constant velocity ' V ' away from an observer standing on the platform. The ratio of the natural frequency of the whistle "n' to the apparent frequency is $1 \cdot 2 : 1$. If the train is at rest and the observer moves away from it at the same velocity 'V', the ratio of 'n' to the apparent frequency is

(A) $0.51 : 1$ (B) $1 \cdot 25 : 1$
(C) $2 \cdot 05 : 1$ (D) $1 \cdot 52 : 1$

24. A stationary wave is formed having 4 nodes along the 120 cm length of the string. The wavelength of the wave is

(A) 20 cm (B) 40 cm
(C) 80 cm (D) 60 cm

25. A string of mass $0 \cdot 1$ kg is under a tension $1 \cdot 6$ N. The length of the string is 1 m. A transverse wave starts from one end of the string. The time taken by the wave to reach the other end is

(A) 0.30 s. (B) 0.50 s.
(C) 0.25 s (D) 0.75 s

26. Two progressive waves $Y_1 = \sin 2\pi\left(\frac{t}{0{\cdot}4} - \frac{x}{4}\right)$ and $Y_2 = \sin 2\pi\left(\frac{t}{0{\cdot}4} + \frac{x}{4}\right)$ superpose to form a standing wave. x, Y_1 and Y_2 are in SI system. Amplitude of the particle at $x = 0.5$ m is $\left[\sin 45^\circ = \cos 45^\circ = \frac{1}{\sqrt{2}}\right]$

(A) $2\sqrt{2}$ m (B) 2 m

(C) $\sqrt{2}$ m (D) $\frac{1}{\sqrt{2}}$ m

27. A capacitor is charged by a battery and energy stored is 'U'. Now the battery is removed and the distance between plates is increased to four times. The energy stored becomes

(A) 4U (B) U.

(C) 3U (D) 2U

28. Seven capacitors each of capacitance $2\mu F$ are to be connected to obtain equivalent capacitance of $\left(\frac{10}{11}\right)\mu$F. Which of the following combination is possible?

(A) 3 in parallel and 4 in series (B) 2 in parallel and 5 in series

(C) 5 in parallel and 2 in series (D) 4 in parallel and 3 in series

29. In potentiometer experiment, the balancing length with a cell E_1 of unknown e.m.f. is ℓ_1'cm. By shunting the cell with resistance RΩ, the balancing length becomes $\frac{\ell_1}{2}$ cm, the internal resistance (r) of a cell is

(A) $r = 0$ (B) $r = \frac{R}{2}$

(C) $r = 2R$ (D) $r = R$

30. If only 2% of the total current passes through an ammeter having coil of resistance 'R' then the resistance of the shunt of an ammeter is

(A) 49R (B) $\frac{R}{50}$

(C) $\frac{R}{49}$ (D) 50R

31. In the experiment to determine the internal resistance of a cell (E1) using potentiometer, the resistance drawn from the resistance box is 'R'. The potential difference across the balancing length of the wire is equal to the terminal potential difference (V) of the cell. The value of internal resistance (r) of the cell is

(A) $R\left(\frac{E_1}{V} + 1\right)$ (B) $R\left(\frac{V}{E_1} - 1\right)$

(C) $R\left(\frac{V}{E_1} + 1\right)$ (D) $R\left(\frac{E_1}{V} - 1\right)$

32. A cyclotron's oscillator frequency is 'n' and radius of the dees is 'r'. The operating magnetic field (B) for accelerating protons of charge ' q' and kinetic energy of protons produced by the accelerator is respectively ('m' and ' v ' be the mass and velocity of proton)

(A) $\frac{2\pi nm}{q}, \frac{qvBr}{2}$ (B) $\frac{\pi nm}{q}, \frac{qvBr}{2}$

(C) $\frac{2\pi nm}{q}, qvBr$ (D) $\frac{4\pi nm}{q}, \frac{qvBr}{2}$

33. A wire carrying current 'I' along x axis has length ' ℓ ' and it is kept in a magnetic field $\vec{B} = (\hat{i} + 2\hat{j} - 3\hat{k})B\frac{Wb}{m^2}$. The magnitude of magnetic force acting on the wire is

(A) $\sqrt{15}I\ell B$ (B) $\sqrt{11}I\ell B$

(C) $\sqrt{13}I\ell B$ (D) $\sqrt{19}I\ell B$

34. Two identical thin bar magnets are placed mutually at right angles such that the north pole of one touches the south pole of the other. The length of each bar magnet is ' ℓ'. The magnitude of resultant magnetic moment of the system is [m = pole strength of the pole of magnet]

(A) $2\,m\ell$ (B) $\sqrt{2}\,m\ell$

(C) $m\ell$ (D) $\sqrt{3}\,m\ell$

35. A bar magnet having length 5 cm and area of cross-section 4 cm^2 has magnetic moment $2Am^2$. If magnetic susceptibility is 5×10^{-6}, the magnetic intensity will be

(A) $0 \cdot 2 \times 10^{10}\frac{A}{m}$ (B) $0.5 \times 10^{10}\frac{A}{m}$

(C) $5 \times 10^{10}\frac{A}{m}$ (D) $2 \times 10^{10}\frac{A}{m}$

36. Relative permeability of an iron is 5500 , then its magnetic susceptibility will he

(A) 5500×10^{-3} (B) 5500×10^{3}

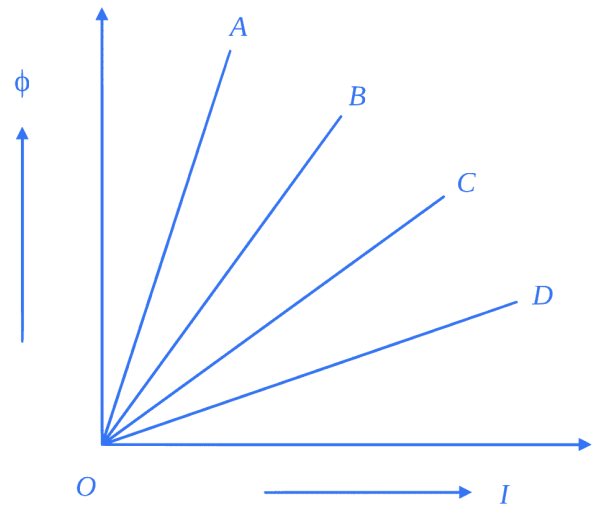
(C) 5499 (D) 5501

37. Two concentric circular coils having radii r_1 and $r_2, (r_2 << r_1)$ are placed co- axially with centres coinciding. The mutual induction of the arrangement is (Both coils have single turn) (μ_0 = permeability of free space)

(A) $\frac{\mu_0\pi r_2^2}{r_1}$ (B) $\frac{\mu_0\pi r_1^2}{r_2}$

(C) $\frac{\mu_0\pi r_1^2}{2r_2}$ (D) $\frac{\mu_0\pi r_2^2}{2r_1}$

38. A graph of magnetic flux ϕ versus current (I) is shown for four inductors A, B, C, D. Smaller value of self inductance is for inductor



(A) A
(B) C
(C) B
(D) D

39. Which one of the following statements is 'NOT" the property of light?

(A) Light involves transportation of energy.
(B) Light can travel through vacuum.
(C) Light requires material medium for propagation.
(D) Light has finite speed.

40. A simple microscope is used to see the object first in blue light and then in red light. Due to the change from blue to red light, what is the effect on its magnifying power?

(A) Magnifying power increases.
(B) Magnifying power decreases.
(C) Magnifying power is independent of colour of light.
(D) Magnifying power remains constant.

41. Light travels from an optically denser medium 'A' into the optically rarer medium 'B' with speeds $1 \cdot 8 \times 10^8$ m/s and $2 - 7 \times 10^8$ m/s respectively. The critical angle between them is (μ_1 and μ_2 are the refractive indices of media A and B respectively.)

(A) $\sin^{-1}\left(\frac{2}{3}\right)$
(B) $\sin^{-1}\left(\frac{3}{4}\right)$
(C) $\tan^{-1}\left(\frac{2}{3}\right)$
(D) $\tan^{-1}\left(\frac{3}{4}\right)$

42. A parallel beam of monochromatic light of wavelength 5×10^{-7} m is incident normally on a single narrow slit of width 10^{-3} mm. At what angle of diffraction, the first minima is observed?

(A) $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$
(B) $\sin^{-1}(1)$
(C) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$
(D) $\sin^{-1}\left(\frac{1}{2}\right)$

43. distance between slit and eyepiece. When the distance between two virtual sources is changed from d_A to d_B, then the fringe width is changed from Z_A to Z_B. The ratio Z_A to Z_B is

(A) $\left(\frac{d_A}{d_B}\right)^2$
(B) $\left(\frac{d_A}{d_B}\right)$
(C) $\left(\frac{d_B}{d_A}\right)$
(D) $\sqrt{\frac{d_B}{d_A}}$

44. When the work function of a metal increases, maximum kinetic energy of emitted photoelectrons

(A) first decreases and then increases.
(B) increases.
(C) remains same.
(D) decreases.

45. Photons of wavelength λ ' are incident on the cathode of a photocell. Electrons are emitted from the cathode surface. The de-Broglie wavelength of the emitted electrons is (work function is negligible) (c = velocity of light, h = Planck's constant, m = mass of electron)

(A) $\sqrt{\frac{mc}{2h\lambda}}$
(B) $\sqrt{\frac{h\lambda}{2mc}}$
(C) $\sqrt{\frac{2h\lambda}{mc}}$
(D) $\sqrt{\frac{mh}{\lambda c}}$

46. If the potential difference used to accelerate electrons is doubled, by what factor does the de-Broglie wavelength associated with the electrons change?

(A) Wavelength is decreased to $\frac{1}{3}$ times.
(B) Wavelength is increased to $\frac{1}{2}$ times.
(C) Wavelength is increased to $\frac{1}{\sqrt{2}}$ times.
(D) Wavelength is decreased to $\frac{1}{\sqrt{2}}$ times.

47. Assuming the atom in the ground state, the expression for the magnetic field at a point (nucleus) in hydrogen atom due to circular motion of electron is [μ_0 = permeability of free space, ϵ_0 = permittivity of free space, m = mass of electron, e = electronic charge, h = Planck's constant]

(A) $\frac{\mu_0 e^7 \pi m^2}{8\epsilon_0^3 h^5}$

(B) $\frac{\mu_0 \pi m^2 e^5}{8\epsilon_0^3 h^3}$

(C) $\frac{\mu_0 \pi m e^4}{8\epsilon_0^3 h^3}$

(D) $\frac{\mu_0 \pi m^3 e^4}{8\epsilon_0^2 h^2}$

48. In an oscillator, if ' β' is the feedback factor and 'A' is the gain of amplifier then sustained oscillations are obtained when

(A) $\frac{A}{\beta} = 1$

(B) A $\beta < 1$

(C) A $\beta = 1$.

(D) $A\beta > 1$

49. The figure shows two diagrams in which diode and resistance are connected. Out of the following statements which one is TRUE?



Diagram (a)

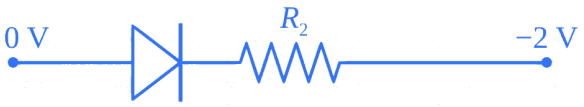


Diagram (b)

(A) diagram (A) and diagram (B) both are forward biased.

(B) diagram (A) forward biased and diagram (B) reverse biased.

(C) diagram (A) and diagram (B) both are reverse biased.

(D) diagram (A) reverse biased and diagram (B) forward biased.

50. The digital signals are used for transmission in communication system. They are

(A) only of discrete stepwise values.

(B) sound and picture signals in television.

(C) continuous variations of current or voltage.

(D) fundamental sine waves.

51. What is the number of moles and total number of atoms respectively present in $5 \cdot 6\ cm^3$ of ammonia gas at STP?

(A) $2 \cdot 50 \times 10^{-3}$ mol and $1 \cdot 5 \times 10^{20}$ atoms

(B) 1.505 mol and 6.022×10^{20} atoms

(C) $2 \cdot 05$ mol and $1 \cdot 50 \times 10^{20}$ atoms

(D) $2 \cdot 50 \times 10^{-4}$ mol and $6 \cdot 022 \times 10^{20}$ atoms

52. Mole fraction of solute in it's 2 molal aqueous solution is

(A) 28.775

(B) 0.034

(C) 0.054

(D) 0.018

53. The H-N-H bond angle in NH_3 molecule is

(A) 101°

(B) 90°

(C) $109^\circ 28'$

(D) $107^\circ 18'$

54. Which of the following compounds has highest boiling point?

(A) $CH_3(CH_2)_2CH_2OH$

(B) $C_2H_5CH(CH_3)_2$

(C) $CH_3(CH_2)_2CH_2NH_2$

(D) $(C_2H_5)_2NH$

55. Which of the following has highest boiling point?

(A) 1% urea solution

(B) 1% sucrose

(C) 1% NaCl solution

(D) 1%$CaCl_2$ solution

56. A gas has a volume of $3 \cdot 4$ L at 25°C. What is the final temperature if the volume increases to $10 \cdot 2$ L at constant pressure.

(A) 1894 K

(B) 694 K

(C) 894 K

(D) 394 K

57. For following reaction, relation between ΔH and ΔU is $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$

(A) $\Delta H = \Delta U - 2RT$

(B) $\Delta H = \Delta U - RT$

(C) $\Delta H = \Delta U + 2RT$

(D) $\Delta H = \Delta U + RT$

58. In an isothermal and reversible process, $1 \cdot 6 \times 10^{-2}$ kgO_2 expands from $10 dm^3$ to $100 dm^3$ at 300 K, work done in the process is $(R = 8.314\ J)$

(A) -1436 J

(B) -5744 J

(C) -4308 J

(D) -2872 J

59. For the combustion of 1 mole of liquid benzene at 298 K, the heat of reaction at constant pressure is -3268 kJ mol^{-1}, what is heat of combustion at constant volume? $(R = 8 \cdot 314 \times 10^{-3}\ kJ\ K^{-1}\ mol^{-1}$

(A) $-3264 \cdot 2$ kJ mol^{-1}

(B) -1632 kJ mol^{-1}

(C) -6728 kJ mol^{-1}

(D) $-672 \cdot 8$ kJ mol^{-1}

60. What is the oxidation state of As in H_3AsO_4 ?

(A) +3

(B) +5

(C) -3

(D) -1

61. Which of the following is used as promoter in Bosch's process?

(A) CO_2

(B) CO

(C) Fe_2O_3

(D) Cr_2O_3

62. What is molecular formula of glyceraldehyde?

(A) $C_3O_3H_8$

(B) $C_4O_3H_6$

(C) $C_3O_3H_6$

(D) $C_2O_2H_2$

63. In which of the following molecules, 2π bonds are present?

(A) C_2H_6

(B) C_2H_4

(C) C_2H_2

(D) C_3H_6

64. Which from following compounds does NOT contain phantom atom?

(A) Acetaldehyde

(B) Methyl cyanide

(C) n - propyl alcohol

(D) Propionic acid

65. Which free radical is most stable among following?

(A) $R - \dot{C}H_2$

(B) $R_3 - C^\circ$

(C) $\dot{C}H_3$

(D) $R_2 - C^\circ H$

66. How many optical isomers are possible for a compound having 3 asymmetric carbon atoms?

(A) 9 (B) 8

(C) 3 (D) 6

67. Identify the product C in following reaction. $CH_3CH_2COOH \xrightarrow{NaOH} ACaO, \Delta^{NaOH} B \Delta^{HNO_3} C$

(A) $CH_3CH_2CH_3$ (B) $CH_2 = CH_2$

(C) $CH_3CH_2NO_2$ (D) $CH_3CH_2CH_2OH$

68. An element crystallises in bcc type having atomic radius $1 \cdot 33 \times 10^{-8}$ cm, the edge length of unit cell will be

(A) $2 \cdot 17 \times 10^{-8}$ cm (B) $2 \cdot 66 \times 10^{-8}$ cm

(C) 4.08×10^{-8} cm (D) $3 \cdot 07 \times 10^{-8}$ cm

69. An element crystallises bcc type of unit cell, the density and edge length of unit cell is $4\ g\ cm^{-3}$ and 500 pm respectively. What is the atomic mass of an element?

(A) $125 \cdot 5$ (B) $100 \cdot 1$

(C) $250 \cdot 0$ (D) $150 \cdot 0$

70. Nickel crystallises in a fcc type of unit cell, with edge length 0.3524 nm. Calculate the radius of nickel atom.

(A) 0.1624 nm (B) 0.2164 nm

(C) 0.1426 nm (D) 0.1246 nm

71. 0.5 molal aqueous solution of a weak acid (HX) is 20%. ionised. If K_f of water is $1.86\ K\ kg\ mol^{-1}$, the lowering in freezing point of solution is

(A) $-0 \cdot 56$ K (B) $-1 \cdot 12$ K

(C) $1 \cdot 12$ K (D) 0.56 K

72. How much charge in coulombs is required for the reduction of one mole of Al^{3+} to Al?

(A) $1.930 \times 10^4 C$ (B) $2 \cdot 895 \times 10^5 C$

(C) $2 \cdot 895 \times 10^4 C$ (D) $1.930 \times 10^5 C$

73. Conductivity cell is filled with 0.01 M KCl gives a resistance of 484Ω and conductivity of $0.00141 \Omega^{-1}\ cm^{-1}$ at $25^\circ C$. What is cell constant?

(A) $0 \cdot 682\ cm^{-1}$ (B) $0 \cdot 341\ cm^{-1}$

(C) $0.751\ cm^{-1}$ (D) $0 \cdot 510\ cm^{-1}$

74. The half life of a first order reaction is 6.0 hour. How long will it take for the concentration of reactant to decrease from 0.4M to $0 \cdot 12$M?

(A) $30 \cdot 36$ h (B) 10.42 h

(C) 4.25 h (D) 9.51 h

75. For the first order reaction A $\rightarrow$ B, The rate constant is $0 \cdot 25\ S^{-1}$, if the concentration of A is reduced to half, the value of rate constant will be

(A) $2 \cdot 25\ s^{-1}$ (B) $0.075\ s^{-1}$

(C) $0 \cdot 30\ s^{-1}$ (D) $0 \cdot 25\ s^{-1}$

76. Electrophoresis is used

(A) to count number of particles in colloidal dispersions (B) for stability of colloids

(C) to determine charge on colloidal particles (D) to determine size of colloidal particles

77. Identify the mineral of aluminium from following

(A) Diaspore (B) Limonite

(C) Azurite (D) Chalcopyrite

78. What is the formula of calamine?

(A) $ZnCO_3$ (B) $MgCO_3, CaCO_3$

(C) Fe_2O_3 (D) $FeCO_3$

79. Which among the following group -15 elements forms hydrogen bonding in it's hydride compounds?

(A) Sb (B) P

(C) As (D) N

80. Concentrated H_2SO_4 reacts with PCl_5 to produce

(A) $HClO_2$ (B) SO_2Cl_2

(C) $SOCl_2$ (D) $HClO_4$

81. Chlorine is manufacture by

(A) Ostwalds process (B) Contact process

(C) Haber process (D) Deacon process

82. Which following pair of elements does NOT represent chemical twins?

(A) Nb - Ta (B) Zr – Rf

(C) Mo – W (D) Tc – Re

83. Which among the following lanthanoids has smallest atomic size?

(A) Pr (B) Ce

(C) Sm (D) Pm

84. Identify the formula of potassium trioxalato aluminate (III)

(A) $K_4[Al(C_2O_4)_3]$ (B) $[K_3Al(C_2O_4)_3]$

(C) $Al_3[\ K_3(C_2O_4)_3]$ (D) $K_3[Al(C_2O_4)_3]$

85. Which among the following complexes is a homoleptic and cationic in nature?

(A) $[CoCl_2(en)_2]Cl$ (B) $[Fe(H_2O)_6]Cl_3$

(C) $K[Ag(CN)_2]$ (D) $[F_e(CO)_5]$

86. Identify the compound A and B in following reaction.

$CH_3Cl \xrightarrow{KCN\ (alc.)} A \xrightarrow{2H_2O,\ HCl} B + NH_4Cl$

(A) A = methylisocyanide, B = Methanoic acid

(B) A = Ethanenitrile, B = Methanoic acid

(C) A = Ethanenitrile, B = Ethanoic acid

(D) A = methyl cyanide, B = methanoic acid

87. Which of the following phenols is isolated from defensive secretion of grasshopper species?

(A) 4 - Methylphenol (B) Benzene-1, 3- diol

(C) 2, 5 - dichlorophenol (D) Phenol

88. The product obtained when 2 -methyl-propan- 2 -ol is treated with alumina at 423 K is

(A) Propanone (B) Propene

(C) Propanoic acid (D) Isobutylene

89. Which among the following compounds is treated with benzonitrile of obtain benzophenon in dry ether and then acid hydrolysis?

(A) CH_3COCH_3 (B) C_6H_5MgBr

(C) C_6H_5ONa (D) CH_3MgBr

90. Identify product 'A' in the following reaction $R - C \equiv N \xrightarrow[ii)H_3O^+]{i)DIBAl-H} A$

(A) $R - CONH_2$ (B) $R - COOH$

(C) $R - CHO$ (D) $R - CH_2NH_2$

91. In aqueous phase the order of basic strength of alkylamine is

(A) $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3\ N > NH_3$

(B) $(CH_3)_2NH > (CH_3)_3\ N > CH_3NH_2 > NH_3$

(C) $(CH_3)_3\ N > (CH_3)_2NH > CH_3NH_2 > NH_3$

(D) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3\ N > NH_3$

92. Identify product B in following reaction. Acetanilide $\xrightarrow[conc.\ H_2SO_4]{conc.\ HNO_3}$ A $\xrightarrow[or\ OH^-]{H^+}$ B

(A) P - nitroaniline (B) 0 - nitroacetanilide

(C) Aniline (D) Nitrobenzene

93. Which among the following reagents is used to obtain gluconic acid from glucose?

(A) dil. Nitric acid (B) Acetyl chloride

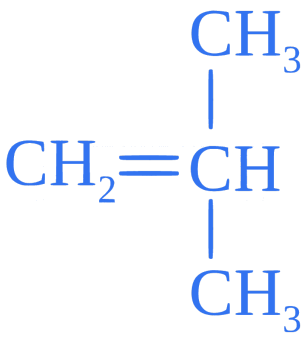
(C) Bromine water (D) Acetic anhydride

94. Which polymer is obtained from monomers 3-Hydroxy butanoic acid and 3Hydroxypentanoic acid?

(A) PHBV (B) Dextron

(C) Nylon-2-nylon-6 (D) HDPE

95. Which among the following monomers is used to prepare Teflon?



(A)

(B) $CF_2 = CF_2$

(C) $CH_2 = CH - Cl$

(D) $CH_3 - CH = CH_2$

96. Sulphapyridine is a/an

(A) antibiotic (B) tranquilizer

(C) antihistamine (D) analgesics

97. Which among the following is used as a fumigant pesticide for strawberries?

(A) $CCl_2\ F_2$ (B) CH_2Cl_2

(C) $CCl_3\ F$ (D) CCl_4

98. Which among the following is a use of 2, 4 - dichlorophenoxy acetic acid?

(A) Antiseptic
(B) Selective drug
(C) Selective weed killer
(D) explosive

99. Which statement about aspirin is NOT ture

(A) It is effective in relieving pain
(B) Aspirin belongs to narcotic analgesics
(C) It reduces body temperature
(D) It has antiblood clotting action

100. Hydroxide of which alkali metal is used in the manufacture of soft soap?

(A) Caesium
(B) Sodium
(C) Potassium
(D) Lithium

101. If $f : R \to R, g : R \to R$ defined by $f(x) = x^2 - 3x + 4$ and $g(x) = 2x + 1$, then the value of x for which $f(x) = f \circ g)(x)$ is

(A) $1, \frac{-2}{3}$ (B) $-1, \frac{2}{3}$

(C) $1, \frac{2}{3}$ (D) $-1, \frac{-2}{3}$

102. If $\cos x + \cos y = -\cos \alpha$, $\sin x + \sin y = -\sin \alpha$, then $\cot\left(\frac{x+y}{2}\right) =$

(A) $-\cot \alpha$ (B) $\cot \alpha$

(C) $-\tan \alpha$ (D) $\tan \alpha$

103. If $y = \tan^{-1}\left(\frac{\sin 2x}{1+\cos 2x}\right)$, then $\frac{dy}{dx} =$

(A) 1 (B) 0

(C) -1 (D) 2

104. If $\tan \theta = 2$ and θ lies in the third quadrant, then the value of $\sec \theta$ is

(A) $-\sqrt{5}$ (B) $\sqrt{3}$

(C) $-\sqrt{2}$ (D) $\sqrt{5}$

105. For $\theta \in \left(0, \frac{\pi}{2}\right)$, $\tan 3\theta \cdot \tan 2\theta \cdot \tan \theta + \tan 2\theta + \tan \theta = 1$, then $\theta =$

(A) $\frac{\pi^c}{12}$ (B) $\frac{\pi^c}{4}$

(C) $\frac{\pi^c}{6}$ (D) $\frac{\pi^c}{3}$

106. The general solution of $\tan \theta + \tan 2\theta = \tan 3\theta$ is

(A) $\theta = (2n + 1)\frac{\pi}{2}, n \in Z$

(B) $\theta = n\pi, n \in Z$ or $\theta = \frac{p\pi}{3}, p \in Z$

(C) $\theta = \frac{n\pi}{5}, n \in Z$

(D) $\theta = (2n - 1)\frac{\pi}{3}, n \in Z$

107. With usual notations, if in $\triangle$ABC, 8 is semi perimeter and $(s - a)(s - b) = s(s - c)$, then $\triangle ABC$ is

(A) an equilateral triangle (B) an obtuse angle triangle

(C) a right angled triangle (D) an acute angle triangle

108. If for the harmonic progression, $t_7 = \frac{1}{10}, t_{12} = \frac{1}{25}$, then $t_{20} =$

(A) $\frac{1}{48}$ (B) 49

(C) $\frac{1}{49}$ (D) 48

109. The equations of the lines which make intercepts on the axes whose sum is 8 and product is 15 are

(A) $3x - 5y + 15 = 0, 5x + 3y + 15 = 0$

(B) $5x - 3y + 15 = 0, 3x + 5y + 15 = 0$

(C) $3x + 5y - 15 = 0, 3y + 5x - 15 = 0$

(D) $3x + 5y + 15 = 0, 5x + 3y - 15 = 0$

110. The cartesian co-ordinates of the point whose polar co-ordinates are $\left(\frac{1}{2}, 120^\circ\right)$ are

(A) $\left(\frac{1}{4}, \frac{-\sqrt{3}}{4}\right)$ (B) $\left(\frac{1}{4}, \frac{\sqrt{3}}{4}\right)$

(C) $\left(\frac{-1}{4}, \frac{-\sqrt{3}}{4}\right)$ (D) $\left(\frac{-1}{4}, \frac{\sqrt{3}}{4}\right)$

111. If the equation $ax^2 + hxy + by^2 = 0$ represents a pair of coincident lines, then

(A) $h^2 = 2ab$ (B) $h^2 = 4ab$

(C) $h^2 = 8ab$ (D) $h^2 = ab$

112. If the equation $ax^2 + by^2 + cx + cy = 0, c \neq 0$ represents a pair of lines, then

(A) $a + c = 0$ (B) $a + b = 0$

(C) $a - c = 0$ (D) $a - b = 0$

113. The equation of the circle whose end points of a diameter are the centres of the circles $x^2 + y^2 + 2x - 4y + 1 = 0$ and $x^2 + y^2 - 8x + 6y + 17 = 0$ is

(A) $x^2 + y^2 - 3x - y - 10 = 0$

(B) $x^2 + y^2 + 3x - y - 10 = 0$

(C) $x^2 + y^2 + 3x + y - 10 = 0$

(D) $x^2 + y^2 - 3x + y - 10 = 0$

114. The focal distance of the point $(4,4)$ on the parabola with vertex at $((0,0)$ and symmetric about y-axis is

(A) 4 (B) 5

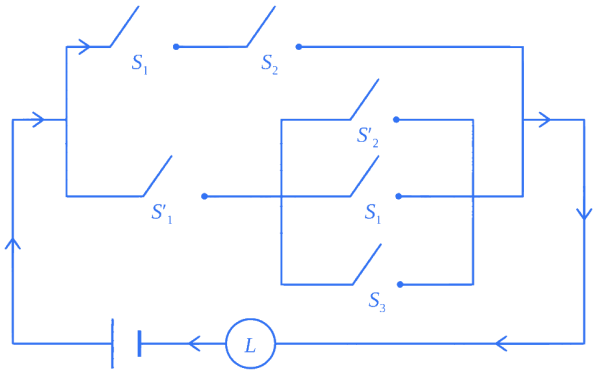
(C) $5\sqrt{2}$ (D) $4\sqrt{2}$

115. The statement pattern $\sim (p \vee q) \vee (\sim p \wedge q)$ is equivalent to

(A) $\sim p$ (B) p

(C) $\sim q$ (D) q

116. The symbolic form of the following circuit is



(where p, q and r represents switches s_1, s_2 and s_3 which are closed respectively)

(A) $(p \vee q) \wedge [\sim p \vee (\sim q \wedge p \wedge r)] \equiv \ell$

(B) $[(p \vee q) \wedge \sim p] \vee [\sim p \vee q \vee r)] \equiv \ell$

(C) $(p \wedge q) \vee [\sim p \wedge (\sim q \vee p \vee r)] \equiv \ell$

(D) $(p \wedge q) \vee \sim p \vee [\sim p \vee p \vee r] \equiv \ell$

117. If $A = \{x/x$ is a prime number, $0 \leq x \leq 9]$, then the number of elements of power set of A is

(A) 12 (B) 4

(C) 16 (D) 8

118. The adjoint of the matrix $A = \begin{bmatrix} 2 & -3 \\ 3 & 5 \end{bmatrix}$ is

(A) $\begin{bmatrix} 5 & 3 \\ -3 & 2 \end{bmatrix}$ (B) $\begin{bmatrix} 5 & -3 \\ 3 & 2 \end{bmatrix}$

(C) $\frac{1}{19}\begin{bmatrix} 5 & 3 \\ -3 & 2 \end{bmatrix}$ (D) $\frac{1}{19}\begin{bmatrix} 5 & -3 \\ 3 & 2 \end{bmatrix}$

119. If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -1 \end{bmatrix}$, then $A^4A^{-1} =$

(A) $\begin{bmatrix} 8 & 0 & 0 \\ 0 & -8 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ (B) $\begin{bmatrix} 8 & 0 & 0 \\ 0 & 8 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{-1}{2} & 0 \\ 0 & 0 & -1 \end{bmatrix}$ (D) $\begin{bmatrix} -4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & -1 \end{bmatrix}$

120. If $f(x) = \left[\tan\left(\frac{\pi}{4} + x\right)\right]^{\frac{1}{x}}$ if $x \neq 0 = k$ if $x = 0$, is continuous at $x = 0$ then $k =$

(A) e (B) $\sqrt{e}$

(C) e^2 (D) e^4

121. If $\tan u = \sqrt{\frac{1-x}{1+x}}$, $\cos v = 4x^3 - 3x$, then $\frac{du}{dv} =$

(A) $\frac{1}{6}$ (B) 1

(C) 2 (D) $\frac{1}{2}$

122. If $y = \left(\frac{x^2}{x+1}\right)^x$ and $\frac{dy}{dx} = y\left[g(x) + \log\left(\frac{x^2}{x+1}\right)\right]$, then $g(x) =$

(A) $\frac{x+2}{x+1}$ (B) $x \log\left(\frac{x^2}{x+1}\right)$

(C) $\frac{x^2}{x+1}$ (D) $\frac{x-1}{x+2}$

123. The maximum value of the function $\frac{\log x}{x}, x \neq 0$ is

(A) e^2 (B) $\frac{1}{e}$

(C) $\frac{1}{e^2}$ (D) e

124. If the line $6x - y - 4 = 0$ touches the curve $y^2 = ax^3 + b$ at the point $(1,2)$ then $a + b =$

(A) 8 (B) -4

(C) 4 (D) 12

125. The approximate value of $\cot^{-1}(1 \cdot 001)$ is

(A) $\frac{\pi}{4} - 0 \cdot 0005$ (B) $\frac{\pi}{4} + 0 \cdot 005$

(C) $\frac{\pi}{4} + 0 \cdot 0005$ (D) $\frac{\pi}{4} - 0 \cdot 005$

126. $\int \frac{dx}{\sqrt{(x-1)(x-2)}} =$

(A) $\log\left|\left(x - \frac{3}{2}\right) - \sqrt{x^2 - 3x + 2}\right| + c$

(B) $\log\left|\left(x - \frac{3}{2}\right) + \sqrt{x^2 - 3x + 2}\right| + c$

(C) $\log|(x-1) + \sqrt{x^2 - 3x + 2}| + c$

(D) $\log\left|\left(x + \frac{3}{2}\right) + \sqrt{x^2 - 3x + 2}\right| + c$

127. $\int \left[\frac{(1+\log x)}{\cos^2(x\log x)}\right] dx =$

(A) $\sin(x\log x)+c$ (B) $\sin^2(x\log x)+c$

(C) $\log(x\log x)+c$ (D) $\tan(x\log x)+c$

128. $\int x^3 \cdot e^{x^2} dx =$

(A) $\frac{1}{2}e^{x^2}\left(x^2+1\right)+c$ (B) $\frac{1}{2}e^{x^2}\left(x^2-1\right)+c$

(C) $\frac{1}{2}e^{x}\left(x^2-1\right)+c$ (D) $\frac{1}{2}e^{x}\left(x^2+1\right)+c$

129. $\int_0^{\frac{\pi}{2}} \frac{\sqrt[3]{\sec x}}{\sqrt[3]{\sec x}+\sqrt[3]{\operatorname{cosec} x}} dx =$

(A) 0 (B) $\frac{\pi}{4}$

(C) $\frac{\pi}{2}$ (D) $\frac{-\pi}{4}$

130. $\int_0^{\frac{\pi}{2}} \frac{1-\cot x}{\operatorname{cosec} x+\cos x} dx =$

(A) 0 (B) $\frac{\pi}{2}$

(C) 1 (D) $\frac{\pi}{4}$

131. $\int_0^{\frac{\pi}{4}} \frac{\sin x+\cos x}{9+16\sin 2x} dx = k\log 3$, then $k =$

(A) $\frac{1}{30}$ (B) $\frac{1}{20}$

(C) $\frac{1}{10}$ (D) $\frac{1}{40}$

132. The area of the region bounded by the curve $y = 4x - x^2$ and the x -axis is

(A) $\frac{16}{3}$ sq. units (B) $\frac{32}{3}$ sq. units

(C) 32 sq. units (D) 16 sq. units

133. $\tan^{-1}x + \tan^{-1}y = c$ is the general solution of the differential equation

(A) $\frac{dy}{dx} = -\left(\frac{1+y^2}{1+x^2}\right)$ (B) $\frac{dy}{dx} = \left(\frac{1+y^2}{1+x^2}\right)$

(C) $\frac{dy}{dx} = -\left(\frac{1+x^2}{1+y^2}\right)$ (D) $\frac{dy}{dx} = \left(\frac{1+x^2}{1+y^2}\right)$

134. The solution of $rdx + \left(x - r^2\right)dr = 0$ is

(A) $r^2x = \frac{r^3}{3} + c$ (B) $rx = \frac{r^2}{2} + c$

(C) $x = \frac{r^3}{3} + c$ (D) $rx = \frac{r^3}{3} + c$

135. A metal has half life period of 10 days, A sample originally has a mass of 1000mg, then the mass remaining after 50 days is

(A) $\frac{225}{8}mg$ (B) $\frac{125}{8}$mg

(C) $\frac{125}{4}$mg (D) $\frac{225}{4}mg$

136. The particular solution of the differential equation $xdy + 2ydx = 0$, when $x = 2$ and $y = 1$ is

(A) $xy^2 = 4$ (B) $x^2y = 4$

(C) $x^2y = -4$ (D) $xy^2 = -4$

137. If the population grows at the rate of 5% per year, then the time taken for the population to become double is (Given $\log 2 = 0.6912$)

(A) 13.624 years (B) $13 \cdot 8240$ years

(C) 13.725 years (D) 13.8275 years

138. If the vectors $\hat{i} + 2\hat{j} + x\hat{k}$ and $yt + 6\hat{k} + 4\hat{k}$ are collinear, then the values of x and y are respectively,

(A) $\frac{4}{3}, 3$ (B) 3,4

(C) $\frac{1}{3}, 1$ (D) 4,3

139. If $\bar{a} = 2i + 3j - \hat{k}, \bar{b} = -i + 2j - 4\hat{k}$ and $\bar{c} = i + j + \hat{k}$, then $(\bar{a} \times \bar{b}) \cdot (\bar{a} \times \bar{c}) =$

(A) -74 (B) 64

(C) -64 (D) 74

140. $\bar{a} = \hat{i} + j + \hat{k}, \bar{b} = \hat{i} - j + 2\hat{k}$ and $\bar{c} = x|+(x-1)\rangle - \hat{k}$. If the vector $\bar{c}$ lies in the plane of $\bar{u}$ and $\bar{b}$, then $x =$

(A) $\frac{2}{3}$ (B) $\frac{-3}{2}$

(C) $\frac{-2}{3}$ (D) $\frac{3}{2}$

141. The equation of a line passing through the point $(2, 4, 6)$ and parallel to the line $3x + 4 = 4y - 1 = 1 - 4z$ is

(A) $\frac{x-2}{4} = \frac{y-4}{3} = \frac{z-6}{3}$ (B) $\frac{x-2}{4} = \frac{y-4}{3} = \frac{z-6}{-3}$

(C) $\frac{x-2}{-4} = \frac{y-4}{3} = \frac{z-6}{-3}$ (D) $\frac{x-2}{-4} = \frac{y-4}{-3} = \frac{z-6}{-3}$

142. The equation of the plane passing through the points $(2, 3, 1), (4, -5, 3)$ and parallel to y -axis is

(A) $x + z = 3$ (B) $x + z = 1$

(C) $x - z = 1$ (D) $z - x + 2 = 0$

143. The direction co-sines of a line which makes equal acute angles with the co-ordinate axes are

(A) $\frac{-1}{3}, \frac{1}{3}, \frac{1}{3}$ (B) $\frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}$

(C) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$ (D) $\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

144. If the lines $\frac{x-1}{5} = \frac{y+1}{3} = \frac{3-z}{\lambda}$ and $\frac{x+1}{4} = \frac{1-3y}{15} = z + 1$ are perpendicular to each other, then $\lambda =$

(A) 2 (B) 3

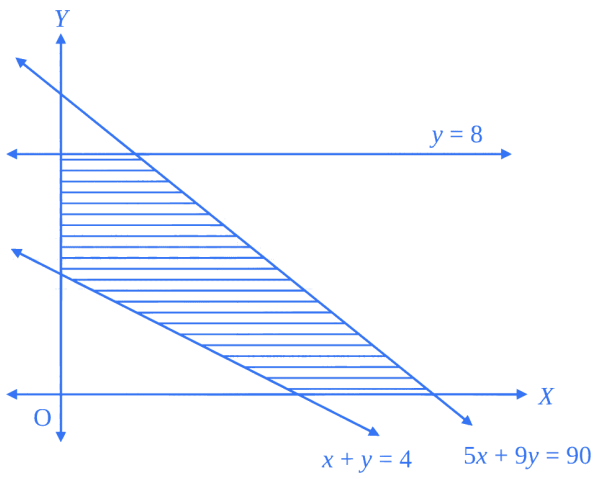
(C) 5 (D) 4

145. The foot of the perpendicular drawn from the origin to the plane $x + y + 3z - 4 = 0$ is

(A) $\left(\frac{2}{11}, \frac{2}{11}, \frac{9}{11}\right)$ (B) $\left(\frac{4}{11}, \frac{4}{11}, \frac{12}{11}\right)$

(C) $\left(\frac{1}{7}, \frac{1}{7}, \frac{6}{7}\right)$ (D) $\left(\frac{1}{5}, \frac{1}{5}, \frac{3}{5}\right)$

146. For the following shaded region the linear constraints are



(A) $5x + 9y \leq 90, x + y \geq 4, y \geq 8, x, y \geq 0$

(B) $5x + 9y \geq 90, x + y \leq 4, y \leq 8, x, y \geq 0$

(C) $5x + 9y \geq 90, x + y \geq 4, y \geq 8, x, y \geq 0$

(D) $5x + 9y \leq 90, x + y \geq 4, y \leq 8, x, y \geq 0$

147. If A and B are independent events such that odds in favour of A is $2:3$ and odds against B is $4:5$, then $P(A \cap B) =$

(A) $\frac{1}{9}$ (B) $\frac{4}{5}$

(C) $\frac{2}{9}$ (D) $\frac{3}{9}$

148. If μ and σ^2 are mean and variance of a random variable X whose p. $m.f.$ is given by $P(X = x) = \binom{6}{x}\left(\frac{1}{3}\right)^x\left(\frac{2}{3}\right)^{6-x}, x = 0,1,2,3, \ldots \ldots 6,$ then the value of $2\mu + 12\sigma^2 =$

(A) 4 (B) 8

(C) 20 (D) 16

149. If the p. m. f. of a random variable X is

X	1	2	3	4	5
P(X = x)	k	$\frac{k}{3}$	$\frac{k}{4}$	$\frac{k}{2}$	$\frac{k}{2}$

then $k =$

(A) $\frac{15}{31}$ (B) $\frac{1}{12}$

(C) $\frac{11}{12}$ (D) $\frac{12}{31}$

150. If the probability density function of a continuous random variable is $f(x) = \frac{x^3}{3}$ if $-1 < x < 2 = 0$, otherwise, then the cumulative distribution function of X is

(A) $\frac{1}{14}\left[x^4 - 1\right]$ (B) $\frac{1}{10}\left[x^4 - 1\right]$

(C) $\frac{1}{16}\left[x^4 - 1\right]$ (D) $\frac{1}{12}\left[x^4 - 1\right]$

- End of Question Paper -